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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/538,972	06/14/2005	Tapani Levola	915-005.168	9487

4955 7590 08/23/2007

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EXAMINER	
PEACE, RHONDA S	

ART UNIT	PAPER NUMBER
2874	

MAIL DATE	DELIVERY MODE
08/23/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/538,972	LEVOLA, TAPANI	
	Examiner	Art Unit	
	Rhonda S. Peace	2874	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 May 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8 and 12-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8,12, 13 and 15* is/are rejected.

7)☒ Claim(s) *14* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 September 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5/29/2007 has been entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1, 3, and 6 are rejected under 35 U.S.C. 103(a) as obvious over Yoshida et al (US 5101297).

Addressing claims 1, 3, and 6, Yoshida et al discloses a diffractive grating element **15** arranged on a substrate **11** with waveguiding layer **12**, and arranged to interact with an incoming light wave from source **40** so that the incident light is coupled into the substrate **11** and is diffracted into a first order wave **21**, which propagates within waveguiding layer **12**, and a second order wave **22**, which propagates within the substrate **11**. The diffraction grating element **15** can be divided into two diffraction grating regions about their axis of symmetry, so that each region has differing diffractive properties due to the grating's **15** curved shape, as seen in Figure 1. As the axis of symmetry, seen along the direction of waveguide layer **12** in Figure 1A, is considered to be a transition point, the regions are substantially mirror images of one another with respect to the transition point. As can be seen in Figures 1A and 1B, the incident light from source **40** first interacts with the grating **15** along the transition point. The diffraction regions mutually compensate for a variation of input angle (see Fig 1) of the incident light wave, so that both first **21** and second **22** order diffracted waves are propagated within the substrate **11** and substrate waveguiding layer **12**. Each of the first **21** and second **22** order waves will inherently have their own diffraction efficiency (column 3 lines 44-61, hereafter indicated as 3:44-61, 4:11-18 and 37-65, Figs 1A and 1B).

Further addressing claims 1, 3, and 6, Yoshida et al does not disclose the function of using the grating to enlarge an exit pupil of an optical system, monocular

system, binocular system, or virtual display. However, as Yoshida et al discloses an optical grating coupler device, it would have been obvious to one of ordinary skill in the art to utilize such a device in any optical system that requires an optical coupler (a grating for coupling light into and out of a substrate), such as a virtual display. Furthermore, it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations (*Ex parte Masham*, 2 USPQ2d 1647 (1987)). Therefore, the recitation, "arranged to enlarge an exit pupil of said virtual display," is not given patentable weight, as it does not denote any structure to the device.

Claims 2 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoshida et al (US 5101297) in further view of Sakai et al (US 5279924).

Pertaining to claim 2, Yoshida et al discloses the grating device as discussed above. However, Yoshida et al does not disclose the grating **15** to be of an asymmetric period profile or a blazed grating. Sakai et al also discloses an optical diffraction grating element that allows incident light to be diffracted into first and second orders that propagate with equal intensities within the substrate supporting the grating (10:1-19, Figure 6C). In addition, Sakai et al also discloses the grating is of an asymmetrical periodic profile, and is preferably a blazed period profile (7:24-27, Fig 1F). It would have been obvious to one of ordinary skill in the art to combine the teachings of a asymmetrical, preferably blazed, periodic profile grating (from Sakai et al) with the

teachings of Yoshida et al, because these gratings types improve the optical efficiency of any device having the grating, such as an optical head device (Sakai et al, 7:37-53).

Regarding claim 4, Yoshida et al discloses the grating device as discussed above. However, Yoshida et al does not disclose the two different grating regions having two substantially differing depths. Sakai et al discloses a grating which is arranged to have two sub-regions **4a** and **4b**, where each sub-region has a substantially different depth, $\mathbf{t_1}$ and $\mathbf{t_2}$, respectively (2:65-68, 3:1-17, Fig 10B). One of ordinary skill in the art would have found it obvious to combine the teachings of Sakai et al (a grating with two sub-regions where each sub-region has a substantially different depth) with the teachings of Yoshida et al, as a grating with differing depths is well known in the art, and a grating with differing depths causes the diffraction efficiency of the first region to be unequal to the diffraction efficiency of the second region, thereby allowing for a grating which can be highly tailored to several desired diffraction efficiencies at various portions along the grating (Sakai et al, 3:13-25).

Claims 5, 7, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoshida et al (US 5101297) in further view of Schultz et al (US 6285813).

With regards to claim 5, Yoshida et al discloses the grating device as discussed above. However, Yoshida et al does not disclose the diffraction efficiency of at least one of the grating regions is arranged to vary at differing local distances from the transition point. Schultz et al discloses a diffraction grating coupler that couples incident light into a substrate. Splitting the grating of Figure 4 into two equal grating regions

where the split occurs at the transition point, clearly Schultz et al also shows the diffraction efficiency of both grating regions are arranged to vary at differing local distances from the transition point (5:37-41 and 60-64, Fig 4). It would have been obvious to one of ordinary skill in the art to combine the teachings of Schultz et al (a grating in which the sub-regions have varying diffraction efficiency along the length of each sub-grating with respect to the transition point) with the teachings of Yoshida et al, as this grating structure is easily adaptable to gain the desired diffraction results, such as diffraction of incident light at a predetermined angle; also this grating structure allows for customization so that the desired light intensity profile along the grating is achieved (Schultz et al, 5:41-64)

Addressing claim 7, Yoshida et al discloses the grating device as discussed above. However, Yoshida et al does not disclose grating regions such that the incident light wave has its first interaction with the grating within a single grating region. Schultz et al discloses a diffraction grating coupler that couples incident light into a substrate, where the grating is fashioned to allow any desired diffraction properties to be realized, as the diffraction efficiency of the grating is dependent upon the slant angle of the grating (5:37-45, Fig 4). In addition, Schultz et al also teaches that light may be incident upon the side of the substrate holding the grating, as well as the top portion of the grating (5:52-59). It would have been obvious to one of ordinary skill in the art to combine the teachings of Schultz et al (that light may be shown on the grating in several locations in order to get the desired diffraction efficiency and intensity) with the teachings of Yoshida et al, as this allows the grating to be manufactured in an extremely

specialized way, such that a wide variety of coupling characteristics can be achieved with the grating by simply varying where light is shown on the grating, as the grating's diffractive characteristics vary along the grating length (Schultz et al, 5:37-65, Fig 4).

With respect to claim 8, Yoshida et al and Schultz et al disclose the grating device as discussed above. Yoshida et al does not disclose having the gratings regions arranged such that at least one of the regions redirects light back in a reverse direction inside the substrate. Schultz et al discloses light may be input from above the grating and be refracted in a reverse direction inside the substrate, with the proper fashioning of the fringes of the grating, as the fringes, having a slant angle, are proportional to the diffraction intensity and also the diffraction angle of the light wave as it travels through the substrate (Fig 4, 5:37-65). It would have been obvious to one of ordinary skill in the art to combine the teachings of Schultz et al (slant angle can be fashioned in a any manner to produce the desired diffraction effect, including the effect where light is recirculated or redirected in a reverse direction within the substrate), as this allows the grating to function in a wide variety of applications, as light may be emitted from either side of the substrate, instead of from just one end.

Claims 12, 13, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakanishi et al (US 2004/0233534).

Pertaining to claims 12, 13, and 15, Nakanishi et al discloses a device comprising a waveguiding substrate **422**, light source **401**, lenses **402** and **421** to direct light from the source **401** to the substrate **422**. Substrate **422** contains diffraction

grating elements **423-425** which diffract incoming light from the source **401** into first order waves L_2 and second order waves L_3. Figure 21A, and paragraphs 0155-0161. Additionally, Nakanishi et al discloses the grating elements **424** and **425** are formed having different diffractive properties. Figure 10, and paragraphs 0098 and 0103. As seen in Figure **21A**, lens **402** has a width which exceeds the width of the beam of light from source **401**, where source **401** is located in the center of the lens axis, and therefore, a second source which is shifted such that an edge of its emitted beam coincided with the edge of the lens width is able to emit light which is capable of passing through lens **402** and lens **421** and be diffracted in the substrate **422** in the same manner as the light emitted from source **401**. It would have been obvious to one of ordinary skill in the art to include a second light source as described above, since it has been held that a mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8. Moreover, it would have been obvious to one of ordinary skill in the art to include a second light source as described above, as the use of a second optical source at the lens edge creates a more uniform light distribution, and reduces optical loss.

Allowable Subject Matter

Claim 14 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The applicable prior art does not disclose or reasonably suggest the device according to claim 12 in combination with the limitation "wherein said input optics is further arranged to shift said second incident light wave on said grating element with respect to said first incident light wave." Nakanashi et al, the closest prior art to the above combination, does not disclose a plurality of light sources, as discussed. While the use of plural light sources is obvious, Nakanishi et al does not disclose or suggest the lenses of Figure 21 shifting light from a second source, on said grating, with respect to light from the first source.

Response to Arguments

Applicant's arguments, see pages 6-7, filed 5/29/2007, with respect to the rejection of claims 12 and 15 under 35 U.S.C. §112 have been fully considered and are persuasive. The rejection of claims 12 and 15 under 35 U.S.C. §112 has been withdrawn.

Applicant's arguments filed 5/29/2007, with respect to the rejection of claims 1, 3, and 6, have been fully considered but they are not persuasive.

With respect to claims 1, 3, and 6, Applicant argues Yoshida et al is capable of displaying a beam which has a fixed direction. As displaying of graphics comprises displaying image points at various locations, Yoshida et al would be unsuitable for use in a graphics display as Yoshida et al is capable of only providing a single fixed image point, or location. The Examiner respectfully disagrees.

Claim 1 does not require the grating to display, or output light, to a plurality of locations for the purpose of projecting an image, and instead simply requires the diffraction grating and virtual display to be within the same device. As previously stated, it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations (*Ex parte Masham*, 2 USPQ2d 1647 (1987)). For this reason, the recitation "arranged to enlarge an exit pupil of said virtual display," is not given patentable weight, as it does not denote any structure to the device. Yoshida et al, used as an optical coupler, would be obvious to incorporate into a virtual display for the reasons cited in the above rejection. This is sufficient to meet the limitations of claim 1, as claim 1 does not structurally require the grating to act as a display unit that produces a plurality of image points at varying locations.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Volodin et al (US 2006/0215972) discloses fiber optic devices having volume Bragg grating elements. Travis (US 7101048) discloses a flat-panel projection display. Levola (US 6805490) discloses a method and system for beam expansion in a display device. Tabata (US 6313888) discloses an image display device.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rhonda S. Peace whose telephone number is (571) 272-8580. The examiner can normally be reached on M-F (8-5).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rodney Bovernick can be reached on (571) 272- 2344. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Rhonda S. Peace
Examiner
Art Unit 2874

MICHELLE CONNELLY-CUSHWA
PRIMARY EXAMINER
8/20/07